FORT FUTURE: MODELING TOMORROW'S ARMY INSTALLATIONS

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Introduction

Research in a program called "Fort Future" will produce tools critical to the Army's ability to transform its installations in the timeframe required to support our emerging forces. Much like field commanders gain a superior advantage by visualizing the battlespace, installation planners will make strategic decisions by "seeing" results of many different scenarios.

Fort Future research and development is being conducted by the U.S. Army Engineer Research and Development Center (ERDC) in support of the Office of the Assistant Chief of Staff for Installation Management (OACSIM). Fort Future will create a "system-of-systems" that unites existing and new computer models to form a virtual installation. Building on the currently available and planned Standard Army Management Information System (STAMIS) that provides a snapshot of the present, Fort Future will use modeling and simulation (M&S) to help decisionmakers explore alternatives in the complex issue of preparing installations to support future forces.

Background

Simulation and Modeling for Acquisition, Requirements and Training (SMART) is an important part of the Army's strategy in procuring Future Combat Systems (FCS). The SMART strategy uses simulation to evaluate the performance of candidate system concepts before committing substantial resources to systems development. Transforming the Army's installations represents a huge national investment for which appropriate choices must also be made. Fort Future follows the SMART approach in allowing installation planners to model and simulate proposed changes to the infrastructure and environment and evaluate their effectiveness.

The initial 5-year Fort Future effort was approved as an Army science and technology objective beginning in FY02. Several M&S tools are under development, with other existing systems being integrated into a suite of Web-based tools.

Objectives

The key objective of Fort Future is to develop a capability to model, simulate, assess, and optimize installation capability to support the Objective Force. Users of Fort Future, at the installation, regional, or national level, will be able to set up planning scenarios, conduct dynamic analysis over a period of up to 30 years, and compare scenario results. Fort Future will allow decisionmakers to do the following:

• Provide an integrated sustainability planning capability to support mission essential task list (METL) analysis, master planning, and natural and cultural resource planning.

• Simulate and optimize planning for force projection. Metrics will focus on risk-based evaluation of an installation's ability to project forces over time.

• Simulate urban and regional growth around installations as a foundation for analysis of mission sustainability. Factors to be evaluated include encroachment, noise, traffic congestion, habitat, and threatened and endangered species.

• Manage facility requirements to rapidly generate, visualize, and analyze facilities for the Objective Force. The analysis will include force protection and sustainability issues.

Approach

Fort Future will integrate existing computer models where feasible and create new modules where necessary. The goal is to present results of M&S as clearly as possible, making maximum effective use of advanced visualization to enhance understanding of a decision's implications. Fort Future will use the following fundamental process:

• Create scenarios,

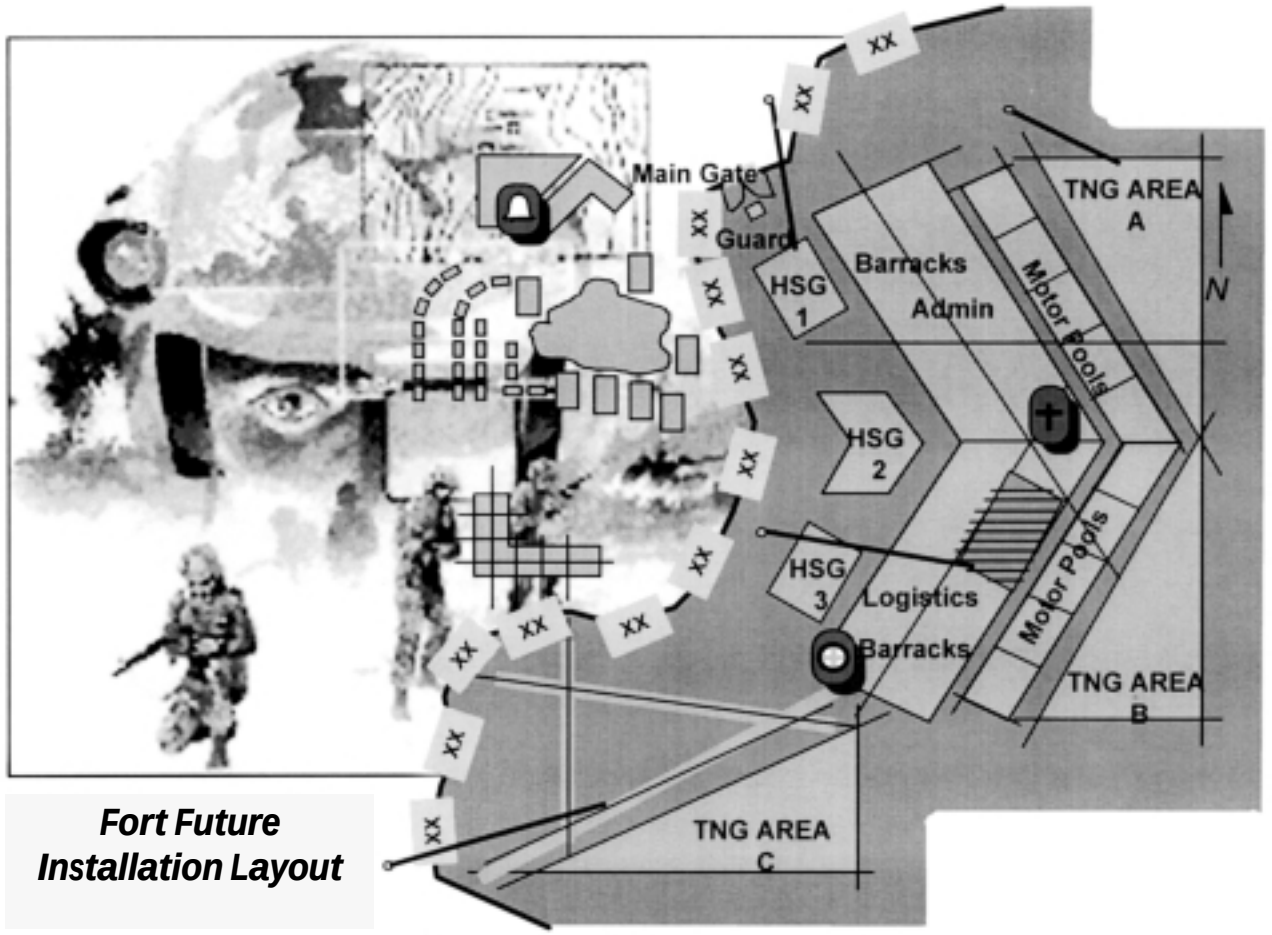
• Conduct analysis using selected computer models,

• Compare and contrast results, and

• Optimize.

The Foundation

The baseline for Fort Future analysis will be created using data from STAMIS and other publicly available repositories. For example, the U.S. Army Training and Doctrine Command (TRADOC) Corporate Database and OACSIM's Geospatial Information System Repository (GIS-R) (see the accompanying article on Page 22 of this issue) pull data from the Installation Status Report, the Integrated Facilities System, and Geographic Information System (GIS) maps into a common data store. When properly updated during the normal course of business, such repositories serve as the best source of data about the current status of an installation. Therefore, access to this information will be an essential element of Fort Future. The currently available TRADOC Corporate Database will be used as an initial module.



Fort Future Installation Layout

Achieving systems interoperability can be a daunting task. Fort Future will take advantage of Common Delivery Framework (CDF), which is being developed by the U.S. Army Corps of Engineers (USACE) to support interoperability and reuse of information technology capabilities in all USACE business areas. CDF uses open standards, published by the World Wide Web Consortium, to make software decision tools, models, and guidance available online.

Access to initial Fort Future capabilities will be provided through the Fort Future Workbench, a Web-served application. Through the workbench, installations, Transformation of Installation Management regional centers, and all "front office" elements will be able to set up private M&S workspaces, with a shared lessons-learned capability based on USACE's corporate lessons-learned module. Ultimately, Fort Future services are targeted for portals such as Army Knowledge Online, an OACSIM portal, or the Defense Environmental Network and Information eXchange (DENIX).

Sustainable Planning

Creating alternative scenarios is the key initiating process for Fort Future. Based on results of the installation transformation game, the sustainable planning module of Fort Future will be a planning tool for installations. Using a METL created from a template, the module will guide users through a process to create a tree structure using elements pulled from master plans and integrated natural and cultural resource management plans. For example, users will be able to designate proposed land-use policies on a GIS interface, which will be captured as a data structure in the tree. Using this process, users will create alternative scenarios to be modeled.

Planning Markup Language (PML) will be an integral part of the sustainable planning module. Using an XML [eXtensible Markup Language] format based on open standards, PML will provide a downloadable description of initial conditions and planned policies that can be read by M&S programs. Standardization efforts will build on industry relationships already formed through the DOD CADD [computer-aided drafting and design]/GIS Technology Center.

Force Projection

Objective Force deployment will be modeled using queued network methods and commercial software commonly used in industrial engineering. Fort Future users will be able to download parametric model templates from a Web site and run simulations locally. By correlating stations and resources with facilities on an installation GIS, parameters such as travel time and number of staging areas can be automatically populated.

Initial models have already been constructed using Interim Brigade Combat Team (IBCT) examples obtained from the Military Traffic Management Command-Transportation

Engineering Agency and Fort Lewis, WA. Research will be conducted to determine the degree of correlation between facility condition, planned maintenance, and risk to power-projection capability. Using these models, planners will be able to quantify criticality of facilities and justify resources.

Working with the Force Projection Battle Lab Support Element at Fort Eustis, VA, installation planners will evaluate the force projection module as the installation component within the suite of models used for deployment analysis. An integrated projection simulation capability consisting of multiple installations is also planned.

Training And Sustainability

Army transformation poses serious challenges to training on today's installations. Projections indicate that weapons will shoot farther and training will take significantly more space, with virtual and live training being conducted concurrently. The sustainable training module of Fort Future will be designed to help decisionmakers identify risk factors promptly so that steps can be taken to avoid conditions that might limit training. For example, if installation planners could identify potential areas of high growth and complaints about noise, they could work with local planning boards to establish buffer zones of compatible use.

To predict growth, ERDC is modeling urban and regional dynamics in a system called the Military Land-use Evaluation and Impact Model (mLEAM). The system runs on massively parallel supercomputers that make enormously complex calculations available to users within minutes rather than hours.

The goal of Fort Future is to bring mLEAM to the desktop through a Web interface so that it will be available to installation and regional planners. In the first prototype, planners will be able to run mLEAM at Fort Benning, GA, on a secure Web client, and then overlay noise contours for IBCT weapons. Other factors such as threatened and endangered species, traffic congestion, energy use, water consumption, and encroachment frequency will be added, as will a multi-installation analysis capability.

Facility Modeling

Before Objective Force brigades can be deployed, installations must conduct analyses to determine their facility requirements. The difficulty of this task is compounded by the fluid state of information about the FCS and the long lead time (5 to 7 years for large facilities) built into the Military Construction, Army (MCA) and National Environmental Policy Act (NEPA) processes. Installations designated for IBCTs have been overloaded with requirements to produce large numbers of DD Form 1391 planning documents—used to request all military construction projects within DOD—in a very short time. Under the unit set fielding process, systems cannot be fielded until supporting facilities are in place, adding even more pressure on the MCA process.

A Fort Future component called Building Composer will shorten the time required to acquire facilities while ensuring that Objective Force and FCS requirements are met. Building Composer tracks facility requirements, supports planning and design processes, and supports associated analyses. Users will be able to download libraries of requirements from the Fort Future Web site, construct a building program, visualize the building design for sustainability using the Sustainable Project Rating Tool (SPiRiT), obtain a cost estimate, complete a DD Form 1391 planning document, and produce a design-build request for proposal.

The Building Composer team is testing the system by building a requirements library for IBCT maintenance facilities based on lessons learned from Fort Lewis. Military Operations on Urbanized Terrain (MOUT) facility requirements will also be added. An advanced immersive visualization capability is being developed using a facility called the CAVE [Core Automated Virtual Environment] at the University of Illinois. The goal is to test the workability of proposed maintenance facilities using computer models of FCS components. Using this feature, a designer will be able to virtually pull a vehicle into a maintenance bay and visually check factors such as worker and crane access.

Force Protection

The USACE anti-terrorist (AT) planning software (AT Planner) is a primary tool in Fort Future, with events of September 11, 2001, increasing its importance. Fort Future will initially address blast effects and chemical, biological, and radiological (CBR) vulnerability. An initial force protection module will provide a capability to download site and building information to Blast Effects Estimation Model or AT Planner, simplifying the process of setting up a simulation. To protect against CBR threats, new requirements will be incorporated into Building Composer and eventually feed the Defense Advanced Research Projects Agency's Immune Buildings Program. Potential modules for physical security are also being explored.

Conclusion

Fort Future has charted an ambitious course toward providing an installation simulation-based acquisition capability in support of Army transformation. Using an incremental delivery strategy, program planners will rapidly put systems in the hands of users and validate and refine them through the new installation battle lab. Beginning with computer models for single installations, these system-of-systems will evolve to allow multi-installation analysis in support of regional and national goals. Ultimately, Fort Future will support the proposed installation battle lab and sustainable installation planning exercises in ensuring continued mission support in the 21st century.

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